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Experimental and Computational Analysis of Structural and Mechanical Properties of Fibrin Gels OLEG KIM, ZHILIANG XU, Department of Applied and Computational Mathematics and Statistics, University of Notre Dame, IN, ALISA WOLBERG, Department of Pathology and Laboratory Medicine, University of North Carolina, USA, ELLIOT ROSEN, Department of Medical and Molecular Genetics, Indiana University School of Medicine, Indianapolis, USA, MARK ALBER, Department of Applied and Computational Mathematics and Statistics, University of Notre Dame, IN. — An important area in coagulation research is the study of the structural stability of a blood clot, which has important medical consequences. The stability of clots is closely related to the fibrin networks, which provides the structural support for a blood clot. We synthesized, studied, and compared fibrin networks, with and without cells, formed under wild type and hemophilic conditions. The 3D structure of each fibrin network was reconstructed from z-stacks of 2D confocal microscopy sections by implementing novel image analysis algorithms. These 3D images were utilized to establish microstructure-based models for studying the relationship between the structural features and the mechanical properties of the fibrin networks. The mechanical properties were assessed by analyzing the networks' responses to uniaxial tensile and shear stresses, simulating the impact of blood flow on the fibrin network. We will show in this talk that the elasticity of the fiber network predicted by the model agrees well with prior experimental data for small networks. We will also show that a nonlinear worm-like chain model correctly predicts both the alignment of the fibers and the elastic properties of the networks as the clot sample is stretched.

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